

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 956 832 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.11.1999 Bulletin 1999/46

(51) Int. Cl.⁶: A61F 2/06

(21) Application number: 99107454.3

(22) Date of filing: 28.04.1999

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 05.05.1998 US 72846

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(54) Bifurcated stent with improved side branch aperture and method of making same

(57) A bifurcated stent for insertion into a bifurcated vessel such as a blood vessel. In one embodiment, a first sheet is formed into a first leg, a second sheet is formed into a second leg, a third sheet is formed into a stem, and the two legs are attached to the stem. In a second embodiment, a first sheet is formed into a member having a first leg and half of a stem, a second sheet

is formed into a second member having a second leg and half of a stem, and the two stem halves are combined to form the bifurcated stent. In a third embodiment, the stent comprises two sections that are serially inserted and assembled within the vessel at the site of the bifurcation to be treated.

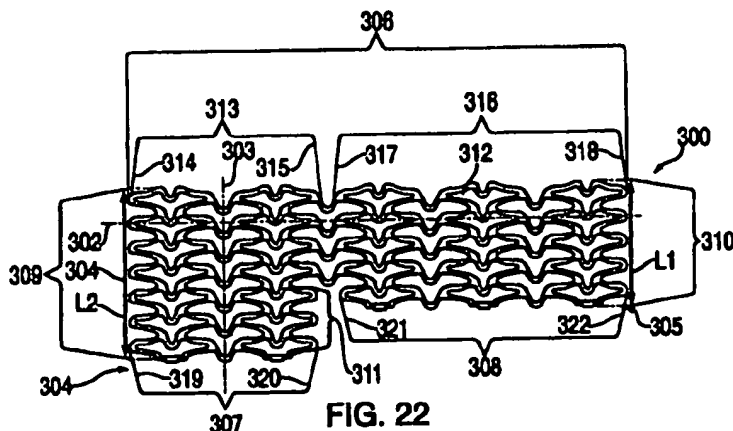


FIG. 22

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Description

Field of the Invention

[0001] The present invention relates to stents, and more particularly to bifurcated stents and methods of making bifurcated stents for insertion within a branching vessel.

Background of the Invention

[0002] Stents are well known in the art. They are typically formed of a cylindrical metal mesh which can expand when pressure is internally applied. Alternatively, they can be formed of wire wrapped into a cylindrical shape or sheets of material formed into a cylindrical shape.

[0003] Stents are devices which are usually implanted within bodily conduits including the vascular system to reinforce collapsing, partially occluded, weakened, or abnormally dilated sections of the blood vessel. Stents also have been successfully implanted in other areas, e.g., the urinary tract or the bile duct to reinforce such bodily conduits.

[0004] U.S. Patent No. 4,994,071 (MacGregor) discloses an expandable, bifurcating stent having a main cylindrical lattice formed from interconnected flexible wire. Two additional cylindrical lattices, having smaller diameters than the main lattice, are similarly constructed. The main lattice includes a flexible wire interconnecting the main lattice to one of the additional lattices. A second flexible wire interconnects the main lattice to the other additional lattice. The flexible wires form backbones that extend axially along the length of the main lattice and along each of the additional lattices. One disadvantage of this bifurcating stent is the complex nature of the interconnection of the flexible wires forming the backbones with the loop structure of each lattice.

Summary of the Invention

[0005] The present invention solves these and other disadvantages of the prior art by providing bifurcated stents and methods of fabricating and deploying bifurcated stents having a stem portion and two leg portions.

[0006] In a first embodiment of the invention, a bifurcated stent is made by providing three sheets patterned to a desired pattern, wherein two sheets are substantially the same size and the third sheet is wider than either of the first two sheets. Each of the sheets is formed into tubes by turning up the longitudinal edges and forming a joint by welding. The larger sheet forms a tube that acts as the stem portion of the bifurcated stent and the other sheets form tubes which act as the leg portions of the bifurcated stent. The two leg portions are then joined to the stem portion to form the bifurcated stent.

[0007] In a second embodiment of the invention, the bifurcated stent is formed by preparing two stent sheets. For each sheet, the longitudinal edges of a portion of the sheet are turned up and secured to each other to form one of the two leg portions of the bifurcated stent. The remaining free edges of each of the two sheets are then joined to form the stem portion of the stent.

[0008] In a third embodiment, the bifurcated stent comprises first and second tubular portions. The first portion has a proximal end which forms the stem portion and a distal end which forms one of the leg portions of the bifurcated stent. A branch aperture is disposed between the proximal end and the distal end of the first portion. The second portion is introduced into the longitudinal bore of the stem portion of the first portion and is advanced through the branch aperture so that it protrudes beyond the branch aperture to form a second leg. When the second portion is expanded, the proximal end of the second portion engages the material defining the branch aperture so as to secure the second leg in the desired position.

[0009] It is an object of this invention to provide a method of making a bifurcated stent, comprising the steps of: a) preparing a first sheet having a first edge, a second edge, a third edge, and a fourth edge; b) preparing a second sheet having a first edge, a second edge, a third edge, and a fourth edge; c) preparing a third sheet having a first edge, a second edge, a third edge, and a fourth edge; d) attaching the second edge to the third edge of the first sheet to form a tubular first leg portion having a proximal end and a distal end; e) attaching the second edge to the third edge of the second sheet to form a tubular second leg portion having a proximal end and a distal end; f) attaching the second edge to the third edge of the third sheet to form a tubular stem portion having a proximal end and a distal end; and g) attaching the proximal end of the first leg portion and the proximal end of the second leg portion to the distal end of the stem portion.

[0010] It is another object of this invention to provide a method of making a bifurcated stent, comprising the steps of a) preparing a first sheet having a proximal end and a distal end; b) deforming the distal end of the first sheet to form a first leg and deforming the proximal end of the first sheet to form a first stem half; c) preparing a second sheet having a proximal end and a distal end; d) deforming the distal end of the second sheet to form a second leg and deforming the proximal end of the second sheet to form a second stem half; and e) joining the first stem half to the second stem half to form a stem.

[0011] It is yet another object of this invention to provide a method of making a bifurcated stent comprising the steps of a) preparing a first expandable tubular member having a proximal end and a distal end and a longitudinal bore therethrough, the first tubular member provided with a branch aperture disposed between said proximal end and the distal end, the branch aperture communicating with said longitudinal bore and the aper-